Tips and tricks for entering a difficult chest via VATS

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Abstract: Recently, video-assisted thoracoscopic surgery (VATS) has been more widely employed in the treatment of various types of thoracic disease. Because almost all VATS approaches are completely via small-sized ports under visual monitoring, dense adhesions between the lung and parietal pleura can be visually obscuring, thus making progress in the VATS approach difficult. In this article, we introduce some tips and tricks for entering a difficult chest during VATS.

Keywords: Video-assisted thoracoscopic surgery (VATS); difficult chest; adhesiolysis

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Introduction

Video-assisted thoracoscopic surgery (VATS) is widely accepted as an alternative approach for treating various types of thoracic disease. In our experience with VATS, severe adhesions between the lung and parietal pleura following infection or as a result of prior thoracic surgery can be problematic. On the other hand, intrathoracic adhesions can be peeled apart relatively simply via dissection under visual monitoring. In this article, we intend to introduce the tips and tricks derived from our experience for entering a difficult chest during VATS.

General VATS procedure tips

In our VATS procedures, we usually use a "confronting upside-down" monitor configuration (1). In brief, two monitors are installed on the cranial side of a patient, one of which is placed upside-down. Regardless of the side of the thorax being operated upon, a primary surgeon stands on the right side of a patient and both camera and second assistants on the left side. Each individual obtains a correct view of the surgical field in the confronting monitor (e.g., on the video monitor watched by surgeon, the left side of the image is the cranial side of a patient).

We usually use three ports (7-, 7-, and 15-mm sizes) for VATS wedge resection or mediastinal tumor resection and four ports (7-, 7-, 15-, and 30-mm sizes) for VATS segmentectomy or lobectomy in patients with malignant lung tumors to conduct both radical and safe procedures (1,2). A given operation is completely performed under thoracoscopic visualization; notably, all structures in the chest cavity are clearly visible using a high-definition camera with 30-degree lens (*Figure 1*).

Port creation in normal cases

The first step of port setting is port installation. Each port is installed at the center of the intercostal space to prevent postoperative neuralgia. After making a skin incision, the muscles are divided by electrocautery. Then, the parietal pleura is opened using a straight instrument without visualization, followed by insertion of the first port and determination of adhesion between the lung and parietal pleura. Other ports are installed under video monitoring (*Figure 2*). If adhesions in the thoracic cavity are detected, we dissect them via electrocautery and/or other energy-based instruments. If a blood vessel is included in the adhesion, we usually use a clip prior to dissection to prevent or mitigate postoperative bleeding following adhesiolysis. In addition, damage to local major vessels, such as the aorta, superior vena cava, or hemiazygos vein, should be carefully avoided. To avoid major vessel injury, we confirm the location of the sympathetic and phrenic nerves during

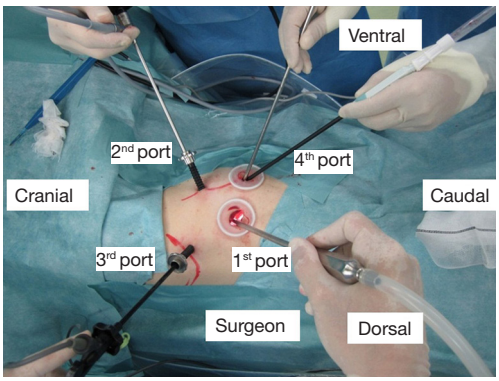

Figure 1 Port placement. The first port is created on the posterior axillary line in the fifth intercostal space (ICS) for use by the right hand of an operator; the second port on the middle axillary line in the third ICS for the camera; the third port in front of the scapula in the third ICS for the left hand of an operator; and the fourth port (when needed) on the posterior axillary line in the fourth ICS for the secondary assistant's use.

Figure 2 Port creation in a normal case (operation on the right side) (3). The first port was placed without visualization, and the other ports under video monitor visualization.
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surgery because these nerves are close to the major vessels. If we confirm them during adhesiolysis, we should pay attention to the major vessel. Essentially, a thorough understanding of the relevant anatomical structures is essential prior to performing adhesiolysis.

Suggestions regarding the approach for entering a difficult chest

While opening the parietal pleura, if the sound of a patient's inhalation is inaudible, this is noted as a sign of possible

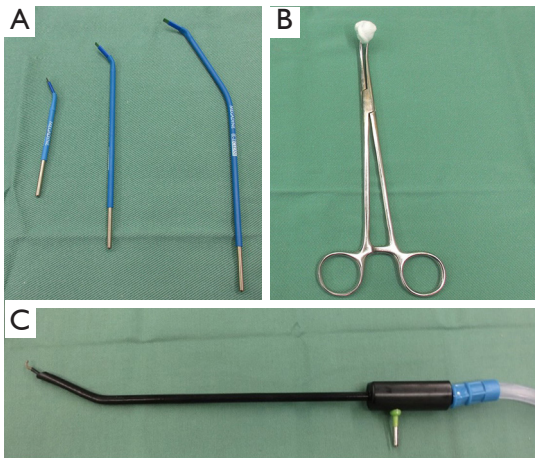

Figure 3 Instruments for adhesiolysis. (A) Tips of the electrocautery; (B) swab; (C) hook-shaped electrocautery with suction tube.

adhesion between the lung and parietal pleura. After setting the first port, we confirm the presence/absence of dense adhesions. If dense adhesions are identified around the first port, we peel them off in the direction of the second (camera) port using the tip of the scope. While entering a difficult chest, the first priority is to establish the second port. After setting the camera port, we can use electrocautery (20 to 40 W power) and swabs to peel off the adhesion near these ports. Electrocautery is advantageous in that the tip can be of varying lengths and can be bent as needed for use in a narrow space (*Figure 3*). However, when only two ports are installed, suction is difficult to use for removing smoke because the deflated lung tends to be re-inflated by the suction. Thus, the second priority is to place the third port. Until then, we attempt to limit the use of open electrocautery devices and suctionless endoscopic devices, despite the mild impairment in visualization by smoke (*Figure 4*). Following the creation of the third port, endoscopic electrocautery can be used with suction, allowing dense adhesions to be dissected under clear visualization. Owing to the possibility of lung injuries in these cases, we are equipped to repair such injuries with both suture and a polyglycolic acid sheet cover and with fibrin glue. In cases comorbid with inflammatory diseases such as tuberculosis and aspergillosis or re-operation, adhesion may be severe. In such situations, we attempt to peel the adhesion off in an extrapleural layer (*Figure 5*).

VATS-based adhesiolysis has some advantages. First, it can be performed under video monitor visualization, reducing blood loss and incidence and extent of lung

Figure 4 Port creation and adhesiolysis in a patient with dense adhesion (4). From the first to second port, the tip of the scope is an effective tool. Then, near the port, open devices such as an electrocautery and swabs are useful to dissect the tissue in a good layer.
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Figure 5 Extrapleural dissection (5). The demonstrated case was a completion right lower lobectomy after wedge resection. A prior staple line had strongly adhered to the chest wall, requiring dissection to be performed in an extrapleural layer.
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injury relative to blind adhesiolysis. Second, endoscopic instruments can be used anywhere in the chest cavity; furthermore, such flexibility improves the selection of appropriate instruments, decreasing operative morbidities including postoperative bleeding and air leakage.

Conclusions

VATS is a useful approach, particularly in cases wherein an adhesion between the lung and parietal pleura has to be peeled off. While entering a difficult chest, we use open instruments (e.g., electrocautery) and swabs to effectively perform blunt dissection near the port. Adhesiolysis performed under video monitor visualization can prevent or mitigate injury to each structure in the thoracic cavity. Finally, in cases of damage, the injured lung should be adequately repaired, and in all cases, bleeding should be controlled to the best of one's ability.

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Footnote

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